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REPORT

OF

EXPERIMENTS AT COLLEGE FARM,

1882.

GENTLEMEN OF THE BOARD OF REGENTS:

According to your instructions, I present a report of the operations of the Industrial College for the year ending December 1st, 1882:

The proper work of this College may be divided into three somewhat distinct parts: (1) Instruction, (2) General Farming, and (3) Experimentation. The first named is, of course, the leading one. The second is made a necessity by the nature of the instruction given. You cannot teach agriculture and horticulture without means of illustration and study, and these means are just what is needed in general farming, viz: a farm, stock, implements, orchards, vineyards, etc. These things are procured and kept primarily for purposes of instruction; but as we have them and must keep them up, every possible effort is made to make them as remunerative as possible. Pecuniary profit is sought, but not at the expense of instruction. The third kind of work, experimentation, is partly for instruction, in the hope of developing in the students a taste for such work, and partly to add our share to the work of improvement in the art of farming, which ought to go on constantly in every civilized community. For the sake of clearness these three kinds of work are discussed separately in this report. In our accounts each, as far as possible, is kept separate from the others.

INSTRUCTION.

This is divided into two lines, Agriculture—including Horticulture—and Civil Engineering. The new course of study adopted in July last is now in use, and seems to be an improvement on the previous one. The principal changes were bringing the practical studies farther forward in the course, and adding one year to it, so as to give to it the same length and difficulty as the other University courses. In some agricultural schools it is the practice to give the students several years of scientific and literary studies before the special agricultural studies are introduced. We have ventured to reverse this order, by putting the purely practical studies early in the course, leaving the sciences to a later time, when they are used as a means of explaining and justifying the instruction given earlier. One important incidental advantage arises from this course; however short the time a student may remain in the school, he is certain to have some instruction in the practical arts and principles of farming.

To illustrate this general statement by an example; the first term a student is in the college, he pursues the study of practical agriculture, which includes such instruction about farming as one ignorant of, or but partially acquainted with the art, could get from a skilled, intelligent farmer. The student reads and discusses such topics as the following: The purposes of cultivation, plowing, harrowing and rolling the soil. The history, habits, varieties and modes of cultivating all ordinary farm crops. Forage crops, special kinds and adaptations. Ensilage. Mixed as compared with special farming, etc., etc. These topics are all studied from the stand-point of the farmer, and with a view to develop the utmost of profit from soil and labor. These subjects are studied by reference to books found in the library, and in doing this the student gradually learns to find knowledge in books, and to read with care and thought, as well as to compare what he reads with the results of his own observation and experience. In the second year Horticulture is pursued in the same general way. Farther on in the course, when Botany, Physiology and Chemistry have been studied, their teachings are applied to the practical studies pursued before.

STUDENTS' LABOR.

While we greatly prefer that our students should work a part of the time, and reserve the right to require it, we have never needed to use any compulsion. Our students all work more or less. We think it better for students to work a part of each day. It is good for their health, both of body and mind. It equalizes the circulation, improves the digestion, hardens the muscle, clears the mind, and steadily develops energy of character. They are paid a fair equivalent for all work done for the college, and they do work for farmers living near the institution. This enables many deserving young men to pay their way through school, who could not otherwise do so. We make it a point to give students who wish it, all the work they want. Some pay their entire boarding this way, but we do not advise students to try to do as much as this, unless it is a matter of necessity.

It will serve to show the large amount of labor done by the students, to state that in the two years covered by this report an average attendance of twenty students have earned as near as can be ascertained, something over two thousand dollars. During a good share of the time they did all or nearly all the work of the College Farm and garden, save that done by one regular man.

It would be much easier for those in charge of the department to get the work done by regular hired men, yet on the whole the advantages of the present plan are so great, that we have no desire or disposition to abandon it. We feel that the effort to help needy and deserving young men to gain an education is a worthy one; yet we seek to do this not by gratuitous aid—from which all right thinking young men would recoil—but by giving them a chance to earn money in a legitimate and honorable way. Surely an industrial school worthy of the name should honor and strive to dignify labor. We believe that the best productive labor of the future is to be the work of willing hands guided by educated minds; mind and muscle working in harmony.

In this connection may be mentioned our need of additional room in our dormitory. Last fall term every room in the dormitory and farm house was occupied, and if other students had come, we could not have accommodated them. Our farm is two miles from town, and students cannot live in town and work on the farm. Thus we are driven to the necessity of providing boarding accommodations at the farm. If we are to have any increase in numbers next season, we must have additional buildings. The present dormitory, erected in 1875, was constructed with the design of adding to it, some time. We estimate that $3,000 for this purpose would give us additional accommodations for from sixteen to twenty more students; and we earnestly represent the desirableness of asking the legislature to appropriate this amount.

MEANS OF ILLUSTRATION.

In some respects we are quite well provided, in some we are still needy. For illustration of agricultural topics we now have a good farm, five breeds of cattle, viz: Short Horns, Herefords, Galloways, Ayrshires and Jerseys, one breed of hogs, Berkshires, one of poultry, Plymouth Rocks, and Clydesdale horses. In comparative anatomy we have skeletons of the horse and the cow. For scientific study we have access to the general University cabinet, now quite well endowed.

WE NEED

a model of the horse, showing the anatomical parts, and one of some domestic bird, as the turkey. These would be of the greatest use in studying the comparative anatomy of the domestic animals. Farther, we should have at least two or three other breeds of animals for instruction purposes. Besides these, there would be economy in keeping a larger number of females of each breed. As we now have to keep males of nearly all the breeds, the relative profit of keeping a number of females, would be considerable. Again, we ought to be able to keep a number of grades of each breed, to enable us to compare them one with another under the same circumstances of care and keeping.

In the horticultural department we would like to plant as soon as possible specimens of all the trees that may be made to grow in this latitude and climate, for the purposes of study and comparison.

In modern agriculture and horticulture increased attention is given to the study of microscopic animals and vegetables. We desire that our students should be practically acquainted with the use of the microscope. To do this, we need a number of compound microscopes for class use. We should have at least six for use the coming year. Suitable instruments can be procured for from $40 to $60 each, and one much better one should be procured for special investigations.

In the engineering department a number of things are needed. We have now only a transit and chain. Mr. Little, instructor in this department, allows the class to use an engineer's level purchased at his private expense. A large number of models of engineering structures might be purchased for a comparatively small amount of money, and would be of the greatestvalue.

GENERAL FARMING.

In this direction the years' work has been highly successful. The crops without a single exception were excellent. The aggregate production was about the following: Corn, 3,500 bushels: potatoes, 350 bushels; onions, 75 bushels; sugar beets, 15 tons; sorghum cane, 295 tons; Grapes, 5,000 lbs.

Our sales during the year were as follows: Live stock, $1,047.24; other farm produce, including sorghum cane, $741.00; garden produce, $103,72; total, $1,951.06. We still have on hand our stock, seed potatoes, some 50 varieties, and vegetables sufficient for the boarding department, for the remainder of the time till vegetables come again. Also corn, hay and other feed to keep our stock through the winter.

Our stock of horses now consists of six work horses, all well on in years. One of them is one of the first two bought for the farm in 1873, and though 17 years old is a good sound horse yet. Another team is 14, and the other about 11. To take their places we have coming on five young horses and colts of various ages, all half or three-fourths blood Clydesdales. We also have the imported Clydesdale horse, Pope. He has proved a valuable breeder, and his stock is beginning to have a high reputation in the neighborhood.

Our stock of cattle consists of 2 Short Horns, 4 Herefords, 6

Ayrshires, 5 Galloways and 2 Jerseys. We have also a few grades, mostly Short Horns and Galloways.

Our farm machinery, new from six to ten years ago, is now becoming considerably worn, and needs a good deal of repairing. The mower we use most, was bought in 1872, the reaper in 1875, the harvester in 1875. Our three corn plows are respectively 10, 8 and 6 years old. Our wagons were second hand when bought, one in 1873, and one in 1874. Most of these things are good for some years yet, but require more careful handling than new ones. I think it will be conceded that they have lasted more than twice as long as such implements usually do in the west.

During the year a considerable amount of fencing has been built for cattle pens, bull pens, etc., and sheds for our fattening steers.

The old barn, which was badly racked, and driven partly from its foundations by a storm in 1881, was repaired, new sills put under it, settled securely on new foundations, and painted.

All the timbers of the farm scales having decayed so as to render it useless, an entirely new frame, bed and platform were provided and put in during the fall. The scales were put in in 1874, and have consequently lasted just eight years. The new timbers were thoroughly coated with hot coal tar, before being put down, and all places where moisture could remain long were filled with the same. The frame put down in this way is good to last the next ten years.

EXPERIMENTS.

The purpose of the work done in this direction was a purely practical one. Though there are many scientific questions connected with agriculture which need answer, we have undertaken nothing of this kind. In the limited number of experiments our time and means enabled us to make, we have undertaken only such as seemed to have an immediately practical bearing. Experiments to be valuable must be carefully conducted; everything must be weighed; measured, or counted. There is no room for guess-work.

The following is a brief account of such of our experiments completed or in progress, as may be of general interest. A considerable amount of time and labor has been expended in preparing for future work of this kind, of which no mention need be made now.

It is proper to state that in carrying on experiments, I labor under the difficulty that I am required to be absent from the farm every forenoon employed in teaching in the University. I do as much teaching as other instructors, and the time and attention needed to keep the work of experimentation going on, must be given at other times in the day. Thus far I have not felt that our fund would justify us in employing a foreman who could be trusted to carry on this work, and have had to give my personal attention to it. This condition of things makes it impossible to do as much in the way of experimenting as we desire.

EXPERIMENTS WITH CORN.

1. Testing varieties of corn grown at a distance, with the design of finding the best kinds for cultivation in this State. The following kinds were planted:

From Michigan—Lackawaxen, Black Mexican, New Triumph and Early Boynton.

From Illinois—Medium Yellow Dent and Large Yellow Dent.

From Minnesota—Early King Phillip and Early Minnesota.

From Missouri—St. Charles White, Mammoth Giant White and Slusher's Mammoth.

From Dakota—Large Yellow Dent.

From Pennsylvania—Chester Co., Mammoth, Maryland White.

It seems unnecessay to report in detail on all of these the first season they were grown. At least one hundred hills of each kind was planted and nearly all did well. Some of them give promise of being very valuable kinds. The Early King Phillip, from seed grown in northern Minnesota, was sufficiently matured by July 10th, to be cut up to feed hogs. The St. Charles White, grown in Missouri in 1881, barely ripened before frost, yet promises well.

2. Two experiments were made in crossing corn from seed grown in a distant locality, with our common field corn grown

here for several years. A large yellow Dent obtained from Dakata county, this State, was planted in rows across a forty acre field, and as soon as the tassels on these rows appeared they were cut off, leaving the ears to be fertilized by the home grown corn. A bushel of this cross, fine looking corn, was saved and will be planted next year and the result reported. It is hoped that by crossing varieties grown far apart, a stronger and more prolific variety may be secured. It is intended to try this on a larger scale next year.

It must be remembered that experiments of this kind to be valuable must be carried on systematically for a series of years. We have had this in mind and have not generally undertaken any but such as we may reasonably hope to be able to go on with for some time time to come.

To test the relative productiveness of corn when a different number of stalks were left in the hill, there was made a careful count of the stalks and hills in nine rows across one of our corn fields. The following is the result:

Whole number of hills planted on piece	2,815
Number of vacant hills	185
" hills with but one stalk	151
" " " two stalks	404
" " " three "	948
" " " four "	852
" " " five "	278

Of those containing but one stalk, one hill in fifteen had no ear; and the same proportion had two ears.

In the hills with two stalks each, one stalk in ten had no ear and one stalk in forty-eight had two ears.

In the class having three stalks in a hill, one stalk in fourteen and a half had no ear and one in fifty-three had two ears.

Of the hills which had four stalks each, one stalk in nine had no ear, and one in every 426 had two ears.

In hills containing five stalks, one stalk in every four had no ear, and there were found no stalks having more than one ear.

To state this in another form: Where there is but one stalk in the hill, about seven per cent. had no ears; with two stalks in the hill, ten per cent had no ears; with three stalks in the hill, seven per cent. of the stalks had no ears; with four stalks in a hill eleven per cent. had no ears, while with five stalks in the hill, twenty-five per cent. had no ears. So that in this case it seems barren stalks in the hills having but one stalk is almost exactly the same as in the hills having three stalks, and that the proportion of stalks without ears, in hills containing four stalks, is but one per cent. greater than where there are but two stalks in the hill.

In the case of hills with five stalks, the proportion of barren stalks rises quite rapidly, there being more than one to the hill, on the average.

The vacant hills were nearly all caused by the prairie squirrels, as the seed was good and came well. The planter used was a new and good one, and when tested rarely dropped less than four grains. It is difficult to account for the large number of hills with only one or two stalks. Some of them had stalks destroyed in cultivation, and some may have been hills where squirrels destroyed only a part of the stalks.

Another count was made in a different part of the same field, with the following result:

Whole number of hills planted	1328
" vacant hills	63
Number of hills with one stalk	48
" " " two "	180
" " " three "	424
" " " four "	590
" " " four or more stalks	117
In the hills with one stalk there were barren stalks	1
" " " " stalks with two ears	13
" " " " " one ear	34
" " two stalks " barren stalks	30
" " " " stalks with two ears	8
" " " " " one ear	302
" " three stalks " barren stalks	118
" " " " stalks with two ears	19
" " " " " one ear	1117
" " four stalks " barren stalks	231
" " " " stalks with two ears	8
" " " " " one ear	1697
" " five or more stalks there were barren stalks	117
" " " " " stalks with two ears	0
" " " " " " one ear	480

The same may be expressed in this way: of stalks where but one was in a hill, one in every forty-eight was barren, and one in four had two ears.

Of stalks where there were two in a hill, one in twelve was barren, and one in forty-five had two ears.

Of stalks where there were three in a hill, one in eleven was barren, and one in sixty-seven had two ears.

Of hills where there there were four stalks, one stalk in eight was barren, and one in 241 had two ears.

Of hills where there were five stalks, one in five had no ears, and there were none containing two ears.

Or it may be stated this way:

With one stalk in a hill two per cent. were barren, and twenty five per cent. had two ears.

With two stalks in a hill eight and a half per cent. were barren, and two per cent. had two ears.

With three stalks, nine per cent. were barren, and one and two-tenths per cent. had two ears.

With four stalks, twelve and a half per cent. were barren, and one and four-tenths per cent. had two ears.

With five or more stalks, twenty per cent. had no ears, and none had two.

Unfortunately, during my absence from the farm and in the class-room of the University, these rows were all husked and thrown together, so that our intention to husk each kind separately could not be carried out.

TAME GRASSES.

Recognizing the importance of the introduction of tame grasses to take the place of natural prairie kinds, now rapidly disappearing, considerable attention has been given to the subject. Our experiments were made with a view to finding the best kinds for our soil and climate, and the best methods of seeding.

In the spring of 1881, fourteen kinds of grass seeds were sown. They were sown in spring without other crop. Nearly all started in the spring, but the excessive drouth of that season killed all but one—Orchard grass, (*Dactylis glomerata*). This grass then, and at other times, has shown extraordinary power to resist the influence of drought. We have had an acre growing on the farm since that date, and it has stood the severest seasons without injury. It starts early, keeps green late and yields a large amount of forage.

In the year just passed we have confined our trials principally to four kinds, viz: Timothy, by some called herdsgrass; Red Clover, Orchard Grass and Kentucky Blue grass.

METHODS OF SEEDING WITH TAME GRASSES.

Several plans have been tried:

1. Sowing very early in the spring on fall sown rye.

Where the rye was pastured and kept rather short the plan has been moderately successful. The rye must not be allowed to grow to high so as to shade the growing grass too much; nor must it be pastured so close as to allow the ground to get heated by the direct rays of the sun. The tramping of the animals pasturing on the rye was evidently an advantage to the grass which grew best where well tramped. One patch of rye which was allowed to mature seemed to have choked out the grass entirely, or what little lived through was burned up by the hot sun of midsummer after the shelter of the rye had been removed.

2. Another plan tried was the following: Somewhat late in the spring, about the first of May, the land was plowed and, sowed to winter rye, and well harrowed to compact the soil and give a smooth surface. On this, timothy, clover and blue grass were sown and lightly brushed in. Five acres treated in this way in the spring of 1882, gave an excellent stand and grew well through the season. The rye grew slowly and spread over the ground so as to shade it somewhat without drawing much on the moisture. This patch had been used for a hog lot and the soil was not in good condition, but it was desirable to get it into grass as soon as possible, and the experiment was tried.

3. The most satisfactory plan tried was to sow the grass seed quite early in the season without any any other crop. To secure the best results on this plan the soil should be plowed the preceding fall and well dragged down, so as to be in shape to re-

tain its moisture. In a fall when the soil is too dry to plow up finely and pack well, it would be better to leave the plowing till spring. Where, as will usually happen on old ground, weeds come up thickly they must be mown down several times during the season.

A piece sown in the spring of 1882, in this way, grew well and bloomed freely in July. June 29th, one square foot of this grass was cut close to the ground and the weight of green grass was just eight ounces. At this rate the green grass on an acre would have weighed over ten tons, and dried, would have produced over two tons of hay. It is true that the early part of 1882 was very favorable for the growth of grass, but an equally luxuriant growth has been seen in other years.

4. We have also had fair success in sowing timothy, blue grass and clover seed on prairie pastures where the grass was partly destroyed.

The chief difficulty here is that the stock keep the tame grass nipped off so close that it has but a poor chance to grow, and consequently is a long time in becoming established.

The value of tame grass for pasture in this State may be considered established. Tame grasses will yield more feed to the acre —excepting only during the dry months; they give a full month more of grazing in the spring before prairie grasses are up, and as much later in the fall. Clover and timothy will retain their hold longer here than in the eastern states. In the dryest part of dry seasons they become quite brown, yet with fall rains, or even the absence of excessive drouth, they become green again. There is but one drawback to their extensive growth for hay, that is the circumstance that it is frequently rainy about the time that the tame grass hay is to be made.

SOILING CROPS.

Being short of pasture for our stock last season, we were compelled to feed green crops to some extent. We found rye, orchard grass and clover mixed, oats, and fodder corn, a succession of soiling crops that kept us supplied without break from June till the frost came. They were fed in the order named above. The corn was planted in drills with a corn planter; stalks three to four inches apart and worked same as other corn. The green forage was at least twenty tons per acre.

The amount of forage that may be obtained from an acre of the different kinds of grass, is shown by the appended tabular statement. It also serves to show the comparative weight of the green forage of different kinds.

June 28th, 1882, I cut a square foot of each of five kinds. In the following table, column 1 gives the name of the grass; column 2, the weight of the grass just after cutting; 3, the weight of each after drying in the shade; 4, the per cent. of loss in drying; 5, the total amount of green forage on an acre like that cut; 6, the weight of the same per acre when thoroughly dried. The prairie grass was cut from good upland prairie:

1. NAME OF GRASS.	2. Oz.	3. Oz.	4. p. ct.	5. Ton	6. Ton
Timothy, (*Phleum pratense*)......................	15	4	73	20.4	5.5
Red Clover, (*Trifofolium pratense*)................	13	2.75	79	17.3	3.6
Orchard Grass, (*Dactylus glomerata*).............	11	3.5	68	14.3	4.6
Blue Grass, Kentucky, (*Poa pratensis*)..........	9	2.5	72	12.3	3.4
Common Prairie Grass, different kinds, mixed	2	0.75	62	2.8	1.1

The timothy was not yet in head; the red clover just coming into bloom; the blue grass and orchard grass just past full bloom and the prairie grass not quite half grown.

In the coming spring we expect to continue and extend our trials of grasses so as to embrace a number of other kinds which seem likely to be suitable to our soil and climate. We intend also to try the effect of cultivation on native prairie grasses, and have already saved the seed of some.

EXPERIMENT IN DRILLING CORN,

To determine the best distance apart for stalks in the row.

(1) Four rows were drilled with one stalk every foot; (2) four with two stalks every two feet; (3) four with three stalks every three feet, (4) and four with four stalks every four feet. These rows were taken entirely across a 40-acre field, were side by side, and on soil as uniform in quality as could be found in the field. The land was second bottom, good corn land that has never been

manured. To ensure a good stand and make the experiment more reliable the corn was drilled more thickly than it was intended to stand and then thinned by hand. The thinning to one stalk in a place took time at the rate of 3½ hours per acre; to two stalks in a hill required 2½ hours per acre. The corn received the usual field cultivation and yielded as follows in bushels of shelled corn per acre:

Plat (1) one stalk every foot, 65.3 bushels per acre.

Plat (2) two stalks every two feet, gave 62.4 bushels per acre.

Plat (3) three stalks every three feet, yielded 53.2 bushels per acre.

Plat (4) four stalks every four feet, gave 43.3 bushels per acre.

As regards the quality of the corn, it varied with the yield. Where but one stalk grew every foot, the ears were larger and finer. In fact as the number of stalks in each plat was substantially the same, the increased yield of some plats over others was due to the increase of the size of the ears. In this case scattering the stalks along one foot apart gave 22 bushels per acre over that of the same number of stalks bunched up four together in the same place. If farther experiment in this direction should verify this result, check rowing corn ought to be abandoned altogether.

A similar experiment was tried in a field where the corn was check rowed. Across this, a 40 acre field, sixteen rows were planted, and then (1) four were thinned to one stalk in the hill, (2) four to two stalks in the hill, (3) four to three stalks in the hill, (4) four to four stalks in the hill. The planter used made rows 3 feet 10 inches apart, and the check rower dropped hills at same distance. The soil was dry upland, which has been cultivated for twelve years constantly, but without manure. The following is the yield in bushels of shelled corn:

Plat (1), one stalk in the hill, 34.1 bushels.

Plat (2), two stalks in the hill, 47.9 bushels.

Plat (3), three stalks in the hill, 50.5 bushels.

Plat (4), four stalks in the hill, 54.3 bushels.

We see here that while there is an increased yield as the number of stalks increase, the yield does not increase in proportion to the number. Four stalks in a hill give but a little more than one-half more than one. The acre with three stalks yielded but 2.6 bushels more than the one with two stalks.

Comparing plat (4) of the check rowed corn with plat (4) of the drilled corn, we see that the check rowed was much the best, in the ratio of 54.3 bushels to 43.3, eleven bushels more per acre. Was this due to the better cultivation possible where the ground could be worked both ways? We think the land where the drilled corn grew, the better corn land, though there may be some doubt of this. There are many interesting questions raised by this experiment to which another year we hope to get answers. It is obvious that we have much to learn yet on so common a subject as growing field corn. These experiments are to be tried again next year in the same form and with variations, if the requisite means are furnished.

EXPERIMENTS WITH POTATOES.

This year we have made a beginning in trying different kinds with a view to testing their productiveness. We planted what purported to be sixty-one different kinds, but on digging and comparing them we found a good many duplicates, and find the actual number to be but forty-seven. They were planted in drills, seed potatoes cut to single eyes, and covered with the harrow. They received ordinary field cultivation. The soil is a medium between high prairie and second bottom. Was manured some years ago, but had no manure within two years. The early part of the season was quite favorable to the growth of potatoes, but the latter part was very dry.

Next season we intend to plant the same quantity of ground with each of these kinds, and a large number of other kinds, some of which we now have on hand and others are yet to be obtained. A careful test of their productiveness, mode of growth, table qualities and keeping qualities will be made and furnished in our next report.

The following is a list of kinds in the order of their productiveness, with yield of bushels per acre appended:

The Grange	519
White Elephant	447
Dunmore's Seedling	305

Early Snow Flake	299
Extra Early Vermont	297
Charlotte	252
Early Rose	248
Extra Early Peach Blow	244
Early Household	242
Peach Blow	241
Alaska	236
Young's Pinkeye	235
Clark's No. 1	213
Indian Russett	210
Climax	208
Brownell's Eureka	208
Nameless	203
American Magnum Bonum	198
Beauty of Hebron	184
Early Ohio	184
Queen of the Valley	182
Mammoth Pearl	166
Manhattan	162
American Giant	161
Advance	160
Adirondack	158
Brook's Seedling	157
Silver Skin	154
Crawford's Seedling	157
White Star	132
Red River Rose	125
Pride of America	121
Robinson's Seedling	120
Galva	106
Bliss' Triumph	99
Vermont Champion	97
Hamburg	96
Saranac	88
Purple Eye	80
Chicago Market	72
Davis' Seedling	67
St. Patrick	56
Mountaineer	43
Gem	41
Mammoth Prolific	28
Matchless	28
Tip Top	24

EXPERIMENTS WITH WHEAT.

Our experiments with this crop have been directed to trials of new kinds, with a view to find kinds specially adapted to our soil and climate.

In the spring of 1871, fourteen plats were sown, each with a different variety. They came on finely and promised well, but the chinch bugs completely destroyed them, so that they were not worth cutting.

Again in 1881, eighteen new varieties from Colorado were sown for trial, but they were all destroyed by chinch bugs long before headed out. Two varieties from Minnesota were badly damaged, but were harvested, yielding a few bushels per acre, of inferior wheat.

We think of trying again the coming season, but there is reason to fear a repetition of the disasters of 1881 and 1882.

FEEDING EXPERIMENTS.

1. To test the relative value of sorghum seed and corn as feed for pigs.

The rapidly increasing cultivation of amber cane, has given prominence to the question as to the best means of utilizing the seed. We have grown on the College farm this season at least 600 bushels of seed, and within two miles of the College at least 3,500 bushels of seed was grown. The only experiment we were able to try was the following:

September 4th, four pigs were shut up each in a separate pen. No. 1 was fed sorghum seed only; No. 2, corn only; No. 3 was fed with sorghum seed and the settlings from the defecating tank at the sorghum works, and No. 4 was fed corn and the settlings from the sorghum works. These settlings included the green substances in the juice which are coagulated by heat and lime, before the juice is boiled down. All had as much as they would eat, and water at will.

The following table gives the result: September 2d, pig No. 2 got sick and was turned out:

	WEIGHT Sept. 4.	WEIGHT Nov. 1.	GAIN 57 days.
No. 1. Sorghum seed only	174	220	46
No. 2. Corn only	120		
No. 3. Seed and settlings	110	155	45
No. 4. Corn and settlings	86	210	124

The corn was fed directly from the field, but was in the best shape to make a pig gain flesh rapidly. The cane seed at first was quite immature and somewhat chaffy. After the first two weeks it was better.

So far as can be judged from this single trial, sorghum seed to feed pigs, is worth about half as much as corn.

As soon as milder weather in the spring comes, we design trying experiments to test the relative value of dry corn and sorghum seed which has been threshed and cleaned. I have good reason to believe that in this condition the sorghum seed will show a greater relative value than in the experiment just detailed.

In the fall of 1881 we weighed out a lot of fattening hogs and fed them a little over a month with sorghum seed and skimmings from the evaporation at the sorghum mill. These hogs were fed the seed that grew on six acres of ground, and an indefinite quantity of skimmings. The total increase in weight of the hogs brought in market just one hundred dollars. No account of the amount of seed fed was kept or of the gain of individual hogs. Nor was it possible to determine the value of the skimmings fed. The experiment shows that it is economical and profitable to feed hogs in connection with sorghum manufacture —nothing more.

EXPERIMENTS IN FEEDING CATTLE.

1. To ascertain the relative profit of feeding one-year-old, two-year-old, and three-year-old steers.

In this experiment which is now going on and will not be completed till next May, we aimed to have all the conditions the same as are usually found in this state where cattle are fed for a business. Four pens were constructed each about four rods by six in size, with an open shed facing the south, and fitted up with feeding troughs and hay racks.

October 25. In one of these pens we put two steers, three past coming four, and weighing respectively 1310 and 1450 pounds. In another pen were put two steers two years old past coming three, weighing 1045 and 1050 pounds respectively. These were half blood Galloways.

December 5. In a third pen were put two half blood Short Horn steers, weighing respectively 975 and 935 pounds. In a fourth pen were put two half blood Short Horn steers one-year-old coming two. These weighed 725 and 815. All the steers are to have all the corn and hay they will eat, and to be weighed monthly. A secondary purpose in feeding the four two-year-olds, was to compare the feeding qualities of the Short Horn and the Galloway grades.

I regret that we were not able to put up all at the same date, but in the early part of the season when the feeding should have begun, we could not procure suitable steers.

I would like to repeat this experiment another year, with a larger number of each age, and include a number of other grades besides those in hand this year.

We have weighed into these pens a lot of hogs, and will keep just enough there to eat up the waste corn. At the conclusion of the experiment, we will weigh them out again to determine how much pork has been made from this waste.

ENSILAGING OF STOCK FOOD.

To determine whether this method of keeping green fodder could be profitably employed in this state and under our agricultural conditions, is the object of this experiment. As the trial is still in progress, it is too soon to give final results, but some account of progress is proper.

The pit was excavated 22 feet long, 12 feet wide and 10 feet deep, a little smaller at the bottom than at the top, so that a thin wall would stand. It was walled with brick set on edge in cement, and a timber wall six feet high, was placed upon the brick wall, so as to extend the first that distance above the top of the ground. The following is the cost, exclusive of building over it:

Excavating	$ 30 00
3,200 Brick	28 00
Cement	10 00
Sand	2 00
Laying Brick	8 00
Cementing wall and bottom	10 00
Lumber	32 00
Carpenter work	5 00
Total	$125 00

The material used for filling the silo was corn. This was planted thickly in drills with a common planter, and cultivated in the usual way. When the corn was tasseled, and was cut by hand, loaded on dumping wagon beds, made for hauling sorghum cane, cut into half inch lengths with a Ramsey feed cutter and tramped well in the pit. The corn was weighed load by load as it was brought to the cutter, the entire amount being sixty tons.

This quantity filled the silo to the depth of fifteen feet, but it afterwards settled to eleven. The yield of stalks per acre was sixteen tons, but some acres went more than this, and some less. A part had been planted too thinly and the stalks were too large to be easily handled. The corn was all a dark green color, and some of the stalks were developing ears approaching the roasting ear stage.

The ensilage was leveled down and covered with common matched flooring boards fastened together in sections three feet wide. This was now covered to the depth of one foot with the earth taken from the pit.

The following is the cost of growing the corn and filling the silo:

Growing the corn:

Rent of four acres of land.	$8 00	
Plowing	5 00	
Seed	1 50	
Planting	1 00	
Harrowing twice	1 60	
Cultivating three times	4 80	
Total		$ 21 90

Filling the silo:

Nine men two and three-fourth days, at $1.25	$30 62	
Four teams, $1.25	14 00	
Putting on earth, $2.50	2 50	
Interest, wear and tear of machine	10 00	
Total		$ 57 12
Total cost of sixty tons		$ 79 02

This is in round numbers $1.30 per ton. Two teams were used on the power attached to cutter, and two others did the hauling.

The above expenses include cutting in field, hauling, tramping, boarding hands and everything.

The silo was opened December 2d, by removing the clay from one of the end sections. It was found in a good state of preservation, even to the top, but the top layer was not so acceptable to stock as a little farther down. Some of it was given to the fattening steers; some of them would not touch it at first, some would cautiously taste. By degrees they came to eat it, so that by the second day they ate ten bushels of it. Now they all eat it with relish. When receiving a full feed of corn, they will eat about thirty pounds per day for each steer.

The first effect noticed was that their appetite for corn was sharpened. They seemed more lively than steers fed on corn and dry forage. Thus far they are gaining well in flesh, though it is too soon to speak definitely of results. It will be observed that the steers here referred to are not the same as those mentioned in connection with the feeding experiment. Certain difficulties that were anticipated have not been met. It was thought that special places for feeding it would have to be provided, but the common feeding boxes used for corn answered every purpose.

It was thought, too, that it could not be fed in very cold weather on account of freezing, but we have had no trouble from that source. We hope to have some definite results to give in our next report.

In a dry, compact soil such as ours, we think it would be safe to cement directly on the earth, with the intervention of a brick wall, though doubtless the wall will last longer in a good condition where brick is used; when it is cemented on earth the walls should slope out a little.

It may be observed that the cost of filling a single silo is greater proportionately than where several are filled at the same time.

The only other trial of ensilage known to the writer to have been made in this State, is that of the West Point Creamery, in Cuming county.

I append here for comparison, some figures taken from a report made by Mr. L. B. Eager, Vice President of the Creamery Company, to the Department of Agriculture, at Washington:

Average yield of corn fodder per acre, (green)	12½ tons
Number of silos	4
Capacity of silos	720 tons
Cost per ton in 1881, including preparation of ground, seed, cultivation, cutting in field, handling, cutting at silo, placing weight, putting up doors, fuel, and housing engine	92 cents.

Mr. Eager reports the greatest yield of cornstalks cut from any one acre to be fifty-eight tons. The average yield he says, was greatly lowered by the small yield on eighty acres of poor, sandy land.

Professor Johnson, of the Michigan Agricultural College, after testing the feeding value of ensilage for one season, estimates that with meal at $25 per ton, hay at ten dollars per ton, corn stalks and oat straw, at four dollars per ton, and rutabagas at forty cents a bushel, ensilage was worth eight dollars per ton.

In the light of our present limited experience we think corn fodder may be put in the silos at a cost of from one dollar to one dollar and fifty cents per ton. It only remains to test the feeding value of food preserved in this way ton for ton, with that dried and kept in the ordinary way. This we hope to do in the future with as much care and exactness as we are able to give it.

PROJECTED EXPERIMENTS.

During the next and following years, we expect, if means are furnished, to undertake or continue the following experiments. Some of these are already begun, and ought to be continued a number of years. Tests made in a single year are not to be relied on implicitly.

1. Experiments to test the relative profit of fattening steers of different ages.

2. To determine the relative fattening capacity of the grades of the different beef breeds.

3. To test the relative profit of keeping cattle of different breeds, both full bloods and grades.

4. To test the relative value of the several milking breeds.

5. To test the relative profit to be derived from keeping grade cattle as compared with the common stock.

6. To test the comparative value of different breeds of hogs.

7. To test the economy of feeding hogs green feed during the summer instead of corn only.

8. To continue and enlarge our experiments with tame grasses and forage plants.

9. To continue our experiments in growing sorghum, with special reference to the production of sugar, and to the best methods of utilizing the seed.

10. To continue our tests of new varieties of potatoes, with the purpose of finding new sorts of special value to this state.

11. To test varieties of corn from other states, with a view to finding kinds specially suited to our soil and climate.

12. To continue our experiments in crossing varieties of corn, with the design of developing new and improved varieties.

13. To test methods of planting and cultivating corn.

14. To continue our tests of different kinds of wheat, and to try all suggested means of preventing the ravages of chinch bugs.

15. To test the feeding value of ensilage, and different methods of keeping it.

16. To test the economy and profit of what is called "under ground irrigation," for gardens and small plantations.

17. To test varieties of apples, and other fruits, to find new kinds suited to our soil and climate.

18. To compare different timber trees, by planting them together and studying their habits and modes of growth.

19. To find vegetables best adapted to our soil and climate.

20. Experiments to test amount of evaporation from soil during the growing season, and amount required to produce a crop.

THE WEATHER OF 1881 AND 1882.

The following brief account of the weather of the two years covered by this report, are taken from the records of the Nebraska VolunteerWeather service.

1881.

RAINFALL.

The chief characteristic of the rainfall of 1881, was its unequal distribution. While some places had abundant rains, others not far distant suffered from a deficiency. As may be seen by examination of the tables given below, the northeastern part of the State had the most rain, the southeast the least. This is the reverse of the usual condition. The average of all stations in the northeast was 41.68 inches; in the southeast, 29 62.

All places within twenty or thirty miles of the Platte river, and as far west as Kearney, had abundant rains, the average for this region being 38.77, while the average of all other stations in the south and southeast was nearly ten inches less than this amount. The heaviest rainfall for any month was 12.96 inches in September, at Howard, in Nemaha county. This is the largest September rainfall ever reported in this State, and has been exceeded by that of any other month but five or six times in the last thirty years.

This year's experience shows very strikingly that the distribution of rain throughout is more important, in an agricultural point of view, than the amount. The fact seems to be that, one year with another, we have sufficient rain for all agricultural purposes, if it were properly distributed, and that where loss of crops is caused by drouth, the difficulty as often results from the effects of hot, dry winds, as from lack of sufficient rain.

Comparing the mean rainfall of each month during 1881, with the average rainfall in the corresponding month for a number of years, it is found that January had about three-fourths and February three times the usual amount; March about the usual amount in the eastern part of the State, and somewhat above in the west; April, about the average; May, more than usual; June, about the usual amount; July, one inch less than usual; August, less than half the average for thirty years; September, much larger than usual. The rainfall for this month, as in 1881, has been exceeded but five times in thirty years. October, one-third more than usual; December, about two-thirds of the thirty year average. The following table gives the average of all stations in each of the three sections:

1881	Jan.	Feb.	Mch.	April	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Year
Southeast..........	.68	2.58	1.81	2.15	5.00	4.83	1.77	1.89	3.56	3.59	1.12	.60	29.62
Northeast..........	.67	3.18	1.81	3.75	8.77	5.34	5.75	.99	4.87	4.52	1.22	.81	41.68
Southwest..........	1.18	1.93	1.55	2.57	6.62	5.94	3.66	1.57	3.26	2.83	.88	.44	32.43
Northwest..........	1.64	1.97	1.82	2.28	7.62	4.75	4.68	1.17	5.02	3.04	.81	.31	35.11
Average..........	1.04	2.41	1.75	2.44	7.02	4.97	3.96	1.90	4.18	3.49	1.01	0.54	34.71

The following table shows the greatest and least rainfall that occurred in each month in the southeastern part of the State. It shows very strikingly the irregularity of rain distribution:

	Jan.	Feb.	Mch.	April	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
Greatest	1.25	4.18	3.18	4.35	8.55	10.94	3.65	3.69	12.96	7.03	1.70	1.25
Least	.20	1.15	.56	.90	3.50	2.19	.12	0.40	.88	1.90	.55	.41

The average rainfall of the six growing months, beginning with April, for each section of the State, is as follows: Southeast, 19.29; remaining months, 13.33. Northeast, 29.47 inches; remaining months, 12.21. Southwest, 23.62; remaining months, 8.81. Northwest, 25.52; remaining months, 9.59.

1882.

RAINFALL.

The following table gives the average rainfall, by sections of the State, during this year. The four sections are formed by dividing the whole State into four parts, by the Platte river in one direction, and by the sixth principal Meridian, in the other:

1882.	Jan.	Feb.	Mch.	April	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Year.
Southeast	.74	.65	.48	5.42	4.25	4.73	5.30	1.05	.71	3.25	1.28	1.12	28.98
Northeast	.44	.55	.36	3.91	3.94	8.99	5.81	.75	.43	2.38	1.44	1.37	30.37
Southwest	.36	.62	.27	6.10	6.19	3.74	3.66	1.26	1.37	3.11	.32	.93	27.93
Northwest	.62	.85	.03	2.76	6.11	3.71	2.36	1.11	1.04	2.32	.11	.63	21.65
Average	.54	.68	.28	4.55	5.12	6.04	4.28	1.04	.88	2.76	.79	1.01	27.93

The total rainfall of 1882, though almost seven inches less than that of 1881, was more evenly distributed, and did more good. This was especially true of the southeast part of the State. Owing to the local and peculiar distribution of the rains of 1881, the six months beginning with April, show a fair average rainfall, but yet certain places suffered greatly from drouth. For instance while the average of the whole southeast was about 27.21 inches during the six months beginning with April, during the same time at the College but 15.31 inches fell,—but little more than half the average amount.

1881.

TEMPERATURE.

The following table gives the average temperature of each of the months. The first three lines are the mean of observations taken at noon, in the years indicated—1879 and 1880, being given for purposes of comparison. The fourth and fifth lines give the mean derived from three observations for the years indicated. The sixth, seventh and eighth lines are for Omaha alone:

NOON.	Jan.	Feb.	Mch.	April	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Mean
1. 1879	30	34	52	60	77	81	85	85	73	71	45	25	59.8
2. 1880	44	41	46	62	80	81	85	83	73	59	35	23	59.7
3. 1881	18	25	36	54	74	83	89	90.8	76	60	41	40.7	57.3
Mean.													
4. 1880	32	29.4	36.5	52.3	70	71.5	76	73.3	62.3	48	24.3	17.3	48.6
5. 1881	13	20.2	30.6	46.1	67.1	74.2	79.2	80.7	66.1	51.5	32.6	33	48.8
Omaha.													
6. Maximum...	42	43	58	78	86	98	101.5	101	98.8	84.6	64.3	59	......
7. Minimum...	–17	12	6	6	41	57.2	58.2	59	36	31.5	4.8	9.4	......
8. Range........	59	55	52	72	46	40.8	43.3	43	62.8	53.1	59.5	49.6	......

This table shows that while 1880 opened warm and ended cold, 1881 just reversed this, beginning cold and ending warm. This is strikingly shown by comparing the sum of the temperatures of the three winter months, beginning December, 1879, with the three winter months of 1880–81. The former is 110 degrees, the latter 66.

January and February, 1881, were the coldest since 1875. March was eight degrees colder than the average March of the last eight years. More snow fell during these three months than during any corresponding period since 1857. A lower average temperture than April had this year, has been observed but three times in sixteen years. The temperature of May was a little below the usual mean, and that of June and July, somewhat above. In August, the temperature went six degrees above the average of the last fifteen years. September, October and November, were slightly warmer than usual. December, was eight degrees warmer than Dr. Child's thirteen year average at Plattsmouth.

The earlier months of 1881, were cold and stormy, with unusually large amounts of snow. The spring months were quite wet and cold in many places. The latter part of spring and early summer was marked by great heat, accompanied sometimes by hot, dry winds that, wherever the rainfall was not unusually abundant, seriously injured the crops, especially the late corn. These injurious effects were mostly confined to portions of the southeastern section of the State.

During the fall, copious rains fell everywhere and the ground was left in the best condition to work as soon as the frost was out. On the 17th of November the ground froze enough to stop plowing, but soon thawed again, when plowing was resumed and kept up till two days before Christmas. Box elders and willows were reported in leaf at Kearney on the 25th of April, and apple trees on the 26th. Elm trees were in bloom on the 21st, and plums on the 20th of the same month.

1882.

TEMPERATURE.

	Jan.	Feb.	Mch.	April	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Year
NOON	32	42	50	59	62	79	80	85	79	64	46	34	59.3
Mean of 24 hours	24.9	38.1	43.0	51.5	55.6	71.9	70.1	72.9	70.4	51.4	39.4	24.0	51.6

By comparing this table with that giving the temperature of 1881, it will be seen the yearly average of 1882, was a little higher. This was especially true of the months of February, March, September, October and November, which were much warmer in 1882 than in 1881. The monthly range of temperature was greater in the following named months of 1881, than in the corresponding months of 1882, viz: January, April, May, July, August, September; while the reverse is true of the remaining months.

The greatest monthly range in 1881, was 72° in April; the greatest in 1882, was 72° in March.

MISCELLANEOUS.

Ice broke in the Missouri at Omaha, on February 11th; at Nebraska City, on the 10th.

Wheat was sown in Saline county on the 10th of February. Robins were seen in Cass county on February 8th. Blue birds in Otoe county on the 9th. Soft maple was in bloom at Crete on March 31st. Apricots were in bloom at Peru, on 9th of March. At Kearney plums were in bloom April 9th.

There was a light snowfall in the northeast part of the State, on May 23d, and a light frost in many parts of the State, on the same date. But little harm was done. The earliest frost in the fall was in Cass county, on August, 21st, but did no harm.

CIRCULAR OF THE INDUSTRIAL COLLEGE.

For the information of those into whose hands this pamphlet may come, and who may not be acquainted with the institution, a brief account of its course of study, and general arrangement is appended. *The object of the school* is to train up a body of intelligent, practical, progressive farmers.

AGRICULTURAL COURSE.

In arranging the Agricultural Course two governing principles have been regarded: 1. Prominence is given to the sciences in proportion to their directness of their relation to farming. 2. The effort is made to give the student year by year, such knowledge and skill as will be of the greatest value to him should he leave college before completing a full course. The student has two or more Agricultural or Horticultural studies in each year of his course.

I. Practical Agriculture, including methods of doing farm work, the history, varieties and management of cultivated crops.
II. Laying out and improving farms. Farm Implements and Machinery.
III. Anatomy and Physiology of Domestic Animals.
IV. Stock Raising—Practical methods of handling, feeding and growing stock. History, characteristics and adaptations of different breeds.
V. How Crops Feed or the Chemistry of Plant Nutrition.
VI. History and Literature of Agriculture. The relations of the development of agricultural knowledge to the advance of civilization.

HORTICULTURE.

The object of this study is to make students familiar with the science and art of plant and tree culture. The student learns to apply his knowledge of Botany and Chemistry, to the understanding of the laws of plant growth—Vegetable Physiology. Each student will have practice in pruning, grafting, budding and the care of orchard and vineyard. In connection with Cryptogamic Botany, students make a special study of such cryptogamous plants as are injurious to the agriculturist or the gardener.

The study of Entomology, besides the general principles of the science, is confined largely to injurious insects and the means of preventing their ravages. A special study is made of the Natural History of the Bee, and instruction given in the best methods of keeping bees for profit. Under Meteorology are studied the laws of climate and the effects of climate influences on vegetation. Landscape Gardening is studied from Kemp's text-book, with such illustrations as are accessible.

The above is a list of special agricultural and horticultural studies. In addition to this, students who take the full course will pursue an extensive range of studies in connection with the classes in the Academic Department. The following is a list of such studies :

English Grammar, Hygiene, Algebra, English Composition, Chemistry, Physics, Physical Geography, Elocution, Botany, Structural and Cryptogamic, History, Geometry, Physiology, Drawing, Conic Sections, Trigonometry, Surveying, Book-Keeping, Biology, Zoology, Geology, and English Literature. Students not wishing to take a full course may select such studies as they desire and are qualified to pursue.

ADMISSION.

Students wishing to enter must be prepared for examination in Practical Arithmetic, English Grammar, Geography, Orthography and History of the United States.

BOARDING.

Students in the Agricultural and Horticultural Courses live on the College Farm, where board is furnished at cost. During the past year this cost has ranged from $1.90 to $2.40 per week, exclusive of fuel and light. Students of this department who come on the cars the first day of the term, or the day preceding, will be conveyed to the farm free of charge.

LABOR.

Students in the Agricultural Course may be required to work two hours a day for five days in a week, for which compensation will be made at the rate of from ten to twelve cents per hour, according to skill and fidelity. When work can be furnished, students will be allowed to work more than two hours if they desire.

RECITATIONS

in purely Agricultural or Horticultural studies will be conducted in the University building or at the farm, as may be found most convenient. All other studies will be with the regular professors in the College of Literature, Science and Art. Studies are in some cases pursued in regular text-books, and in others by the study of special, assigned topics, using reference books, of which about three hundred volumes are kept at the Farm Library.

APPARATUS OF ILLUSTRATION.

To illustrate the various subjects, this department now has an improved farm of 320 acres, containing orchards, vineyards, timber plantations, the beginning of an arboretum, five breeds of cattle, two of hogs, thirty stands of bees, mounted skeletons of the horse and cow, a human skeleton, and a number of models of the internal organs of the human body, models of the horse's foot, etc. Students in this college have the use of the general Cabinet and Library of the University on the same terms as others.

DEGREES.

In this college the degree of B. Ag., and B. C. E., are given upon the completion of the Agricultural and Civil Engineering Courses respectively.

ADVANTAGES.

The Industrial College now offers to the sons of farmers, or to any who desire to prepare for the higher fields of industrial pursuits, an opportunity to obtain a first class scientific and practical education at such a moderate cost as to bring it within the reach of every young man who has good health and is not afraid or ashamed to work.

For farther particulars or catalogues of the University, address

S. R. THOMPSON,
Dean Agricultural College,
Lincoln, Nebraska.

EXPLANATION.

Page 43, and following that, pages 31 to 42 inclusive, should have been made to follow page 23, and to precede the weather report, now found on page 24. The present disarrangement arose from some misunderstanding of the printer, and was not discovered till the pamphlets were all printed and bound.

EXPERIMENTS WITH MULCHING.

Apples.—In the spring of 1880, one corner of the orchard was mulched all over the ground. The spring of 1881 found the whole orchard full of bloom, but there were but few apples except where the mulching covered the ground the previous season. Some of these trees were very full; a strong and visible argument that apples could be grown in this section of Nebraska.

During the year 1881 the whole orchard was cultivated, with the result in 1882 of all the trees bearing about alike and none of them with many apples. In the spring of 1882, to bring the matter to better proof, alternate rows were mulched in a direction across the rows of varieties. In our next report we shall probably be able to give more convincing proof. The mulching in 1882 was placed around the tree as far out as the limbs reached and about eight inches deep after settling. The material used was the tops and bottoms of hay stacks and old partially decayed straw.

The above, taken with the practice of a man in another part of the state who mulched heavily with the best of results, both in growth of trees and quantity of fruit, seems to give evidence that by utilizing the waste of hay and straw, we can improve very much the products and appearance of our orchards.

The effect on grapes is more striking. Two years ago we became so well convinced that mulching was producing superior results that we no longer kept a part of the vineyard unmulched for purposes of comparison, but covered the whole vineyard. The result the past season was from the one acre of grapes, 3980 pounds weighed, besides those eaten by employes and others, the amount of which would increase the yield five or six hundred pounds. Vineyards of the same age and about as good care otherwise, have not yielded much more than one-half.

It is claimed by some that the quality of the mulched grape is not so good as the cultivated. The difference however is small and but few persons notice it. Customers say they are superior to those shipped from other places. The precaution should be observed that when mulching is commenced it must be followed, the reason seeming to be that the roots under the litter come near to the surface, and if it is taken off the roots are exposed to the heat and drouth of summer and cold of winter, which almost destroys the vine. In regard to the question of which has most to do with this improved growth of tree or vine, lower temperature of the soil under litter or the increased amount of moisture has received our attention especially in regard to temperature. The following are some of the observations: The temperature was taken at a depth of two inches below the surface of the soil in all the observations of soil:

	Date.	Temp. of air at 1 o'cl'k.	Temperature of Soil.			
			7 a. m.	1 p. m.	7 p. m.	Dif. bet. 7 a. m. & 1 p. m.
Under mulching	Aug. 3.	95°	70°	76°	73°	6°
	" 4.	100	73	74	74	1
	" 5.	88	67	73	72	6
Without mulching	Aug. 3.	95	73	108	89	35
	" 4.	100	76	113	94	37
	" 5.	88	67	101	86	34
In cane field, ground not exposed to sun	Aug. 3.	95	74	87	83	13
	" 4.	100	77	90	76	13
	" 5.	88	69	81	80	12
In cane field, ground exposed	Aug. 3.	95	70	105	90	35
	" 4.	100	80	112	94	32
	" 5.	88	70	95	84	25

We see from the above table that there is a great difference between the temperature of soils at different times of the day and the shaded soil as compared with the exposed. There is also quite a uniformity of temperature at all times under the mulching, and that uniformity is at a much lower degree than the exposed soil. Where this low temperature exists and is produced by mulching, it is also more moist, and the growth fully double that where the higher temperature of soil and diminished moisture exists. While the main question is still open, as far as the figures show, yet some useful hints and ideas may be gained. For instance, a very high temperature of soil favors rapid evaporation of moisture as well as being injurious to the roots of vegetation. A comparison of temperature of soil in cane field where the crop was thick enough to shade the ground and where not, gives one point.

Observations were also taken to ascertain at what depth a nearly uniform temperature could be obtained. The result is as follows:

At a depth of two inches the variation between morning and noon observations are as the table above indicates. At four inches and greater depths down to two feet, the highest temperature was not at noon, but at the evening observation. At four inches the average difference was 10½°; at six inches, 7°; at eight inches, 5°; at twelve inches, 2°; at twenty-four inches, about 1°. At a depth of two feet the average temperature was about 75°, or about the same as that two inches below the surface beneath the mulch. Hence for keeping out excessive heat a five-inch mulch of hay and two inches of soil were equal to two feet of earth. The places of equal temperature were also of about equal moisture; or by the use of the mulch the average moisture of two feet in depth could be kept at the surface.

The difference of evaporation under mulching at a temperature of 75° and the exposed soil at 100° is more than two to one. If the temperature of the surface soil should rise to 130°, as it frequently does in the heat of the day, the evaporation is nearly five times as great as at 75°.

The experiments being conducted with varieties of fruit embrace the following:

EXPERIMENTS WITH FRUITS.

Of Grapes: Prentiss, Champion, Janesville, Craton, Miles, New Haven Challenge, Black Hawk, Aminia, Telegraph, Israella, Jefferson, Agawam, Herbamont, Herbert, Cottage, Highland, Lady Washington, Duchess, Black Defiance, Barry, White Hall, Eva, Missouri Riesling, Elvira, Merrimac (No. 19), Lindley, Lady, Black Eagle, Herman, North Carolina, Goethe, Salem (No. 53), Montefiore, Irving, Amber, Black Eagle, Cynthiana, Diana, Rentz, Eumelan, Wilder, Worden, Cunningham, White Ann Arbor, Cambridge, Pearl, Purity, Noah, Massasoit, Maxataung, Brighton, Ives' Seedling, Elmira, Hartford Prolific, Marion, Moore's Early, Perkins, Venango, Tenargua, Dracut, Amber, Beauty, Rebecca, Conqueror, Martha, Triumph, Highland, Catawba, Early Victor, Early Dawn. None of the above are yet in bearing. The one acre of Concords produced this year in round numbers, $140 worth of grapes.

The varieties of strawberries are: Jersey Queen, Longfellow, Warren, Orient, French, Seth Boyden, Prince, Kentucky, Wilson, Capt. Jack, Black Giant, Bridewell, Glendale, Crescent, Sharpless, Mount Vernon, Great American, Satin Gloss, Manchester Forest, Miner's Prolific, Manhattan, Hudleston, Gipsy.

Raspberries: Mammoth Cluster, Seneca, Gregg, Miami, Brinkle's Orange, Davidson's Thornless, Reliance and Queen of the Market. The Mammoth Cluster have always done well—Gregg promises well.

Of apples there are over 100 varieties. It will be some time before the most of them will come into bearing. One that has come into bearing and now generally known, is Cooper's Early White. It has shown itself a very early bearer, and an excellent early apple.

All efforts with currants in the open ground are so far substantially fruitless.

All efforts to grow quinces have proved failures.

Peas.—The varieties grown for standard table peas are the Philadelphia Extra Early or Plant's Early, and Bliss' American Wonder. The first is the earliest and most prolific, the latter the largest and sweetest. These have proved the best by far of all the varieties that have been tried. Many persons fail to get peas to do well. The way to succeed is to plant three or four inches deep in rich ground;

Beans.—For string beans the Golden Wax receives the best name. White Wax and Crystal White Wax were grown the past year, but they do not meet with the favor of the first mentioned.

Arboretum.—The varieties of trees obtained for our collection have grown well the past season. The Russian Mulberry, of so much talk, has proved hardy, but a very bushy grower unless planted very thick to make it grow more upright. If it is to be used to supply food for silk worms as some would have it, it will certainly have the recommendation for not growing high and getting out of reach. But for a timber tree it will be a failure unless planted thick. It grows no better than the common White Mulberry.

The Blue Ash and Black Ash have shown the characteristic of the ash family, being slow growers while young. White Birch grows well, but should be planted thick for timber purposes.

Kentucky Coffee tree very slow grower. The Tulip, or as some call it, the poplar, has not been hardy, getting winter killed, but growing up every summer. The Buckeyes are about as large as when planted three years ago. Sycamore has grown well.

Strawberry tree has made a fair growth. Hard maple has made the past year a good growth, after three years' growth more than half are still alive, with the prospect if they are not moved, of all continuing their growth. We think now that if kept mulched and the bodies protected from the sun, we may yet have some hard maple shade trees.

Catalpa Speciosa. The hardy variety of Catalpa is doing well, making a rapid growth. It should be planted pretty close to grow upright, or be planted with some other tree to be cut out when the Catalpa needs all the space. The Catalpa has one excellent feature in its growth; if it should become small and brushy it can be cut off at the ground, then allow but one sprout to grow and it will soon make up its original size, in a nice straight tree. We remember one in another state that had attained a diameter of ten inches, when it was cut down. One sprout grew up attaining a hight of ten feet and a diameter of two inches at the base the first season.

We have been testing the method of planting Walnuts with nurses. It consists of planting Walnuts 4x4 feet, or any distance thought best, then plant willow cuttings between the Walnuts in rows. The willow grows up rapidly and gives the necessary shade to the Walnut to make it grow upright and much more rapidly than if exposed to the full heat of the sun.

SORGHUM.

This crop still engages the attention of the public. During the past few years it has received the attention of chemists more than ever before. While they have not discovered much of importance, they have been the means of spreading abroad much needed information.

The question as to whether sugar can be obtained in paying quantities, seems now, more than hitherto, probable. To do it, however, requires the appliances in sugar machinery that are used in connection with other sugar producing plants. It can scarcely be done with profit on a scale short of a capital of $50,000. It is of course, made on a much smaller scale, but it will probably not be profitable. At Champaign, Illinois, they have made the past season 86,000 lbs. of sugar from 184 acres, on the first working. The Rio Grande sugar works, New Jersey, have succeeded well for two years in sugar production.

In the two years since our last report, a few things have devoloped which may be of some use to growers and manufacturers of our own State. Our experience in using a short and wide evaporator instead of a long and narrow one, led us to very much prefer the wide one, especially where coal is to be used for fuel. The bulk of the jucie is by this means brought nearer the fire, and evaporation takes place more rapidly.

Judging by the letters of inquiry received, some points in the burning of *bagasse*, or the refuse pressed cane, will be acceptable. We have followed the plan that has been used with success by those who have tried it. In the first place scatter out the *bagasse* to dry. If it has been properly crushed one day's sun is sufficient. When used under the evaporator the grates should be placed at least six inches apart; then use a feeding shoot made of heavy sheet iron, with one end the size of the opening to the furnace and the other end two or three inches larger. Take off the door and fasten on the shoot with the small end fitted to the door opening. In firing keep but a small quantity of the *bagasse* on the grates, but allow it to burn from the inner end of the shoot, keeping the shoot full so as to make a door of it. A good draft is very essential. The chimney should be twice the length of the evaporator. For an evaporator ten or twelve feet long, the inside of the chimney should be at least equal in size to 13x23 inches.

During the season of manufacture, of 1881, the skimmings, washings, etc., were fed to hogs. There were enough of hogs to consume the skimmings as fast as made. They were fed in addition the seed from about six acres of good cane. They were weighed at the beginning and at the close of the season. The gain was two thousand pounds. The number of gallons of syrup made from which skimmings were used, was 1850.

The sugar produced in 1881, was quite different from that of 1880. The sirup separated freely from the sugar in the centrifugal. The grain was better. The previous year there was considerable gummy substance that made it difficult to separate the sugar from the sirup. The yield of the two seasons was about alike; the seasons differed in this, that in 1880, heavy rains occurred at the commencement of the working season, while in 1881, there was but little rain. The heavy rains of 1880, just as the cane was ripening, may have produced the exceedingly gummy sugar of that season.

The past season, a steam outfit was put up adjoining the College Farm. Our efforts were more directly in the line of experiments in planting. One field of 13¼ acres averaged 8.2 per acre. A portion of this field had over ten tons per acre, while a portion of the flat part was quite thin, and gave a smaller yield.

Several persons delivering cane at the mill, reported from six to ten tons per acre. The price paid by the works for sorghum with a test of 10° B, with the blades on, but cured, was $2.00 per ton.

An experiment was tried with different times of planting. It had been observed that volunteer cane ripened much earlier than that planted at the usual time. We planted some in November, then in February, March, April May, June and July. All that was planted previous to the first of May, failed. There is, however, one important feature in nature's planting that we did not observe. Nature plants on top, but we covered from one to two inches deep. One man had succeeded the previous season in getting cane ripe about two weeks earlier than usual, by planting in March, in shallow drills, without covering. The past season the same man planted the same way in March, but cane planted the second week in June, was ahead of it on the 4th of July. It seemed that the season opening early started the seed to growing, then the long spell of cool weather that followed, almost killed it.

Our experience is, that unless the land is very clean, early planting, even up to the 10th of May, is very expensive to keep clean. The first warmth that comes is sufficient to start weeds, but not sufficient to make cane grow, hence the weeds get started first. From the 10th of May, to the middle of June, amber cane may be planted with a good prospect of success. It will lessen the expense of cultivation materially to thoroughly cultivate the ground before planting.

Some of our first of May planting, though the ground was clean when planted, cost four dollars per acre for hoeing, while that planted after the weather became quite warm, required only one dollar per acre for hoeing, and would not have requred that but for about two weeks of wet weather when it should have had its first cultivation.

Cane planted rather thin on the 3d of July, matured before frost. The yield of such late planting is not satisfactory Other things being equal, our best yields were from that planted as soon as the ground became warm enough for it to grow well. The best time, perhaps, is about one week after it is considered warm enough for corn to grow well.

Ordinarily from two to three pounds of seed is sufficient for one acre to make a good stand. Our experience, however, leads us to follow another plan, first suggested by the custom of some of the sugar beet growers; their custom is to plant from twelve to fifteen pounds of seed per acre, when, if all the seed grew in the right place, four pounds would be sufficient. We prefer about ten to twelve pounds of sorghum seed per acre, not in hills but in a continuous drill. If this amount of seed is dropped in hills even one foot apart, there will be too much seed in one place. But if planted in continuous drills no part of the drill is too thick to make good hills when it is cut out between to make hills. The advantage of this quantity of seed, is in the comparative ease, rapidity and cheapness of cultivation. It makes but little difference if a stalk is covered or a clod rolls on the row, there is plenty left. The harrow can be safely used in cultivation under these circumstances. After it is cultivated it can be harrowed across the rows and all leveled down and made clean. If at the height of eight or ten inches it is still too thick it should be chopped out with the hoe, or if thought best, run across the rows with the cultivator with two shovels off. To outline this method it would be as follows, if circumstances did not prevent: Plow the ground early; thoroughly cultivate and harrow smoothly immediately before planting. Plant generally about the 15th of May. Harrow same direction of the rows with a smoothing harrow before cane comes up. In a week after cane is up cultivate. After four or five days harrow across if it will bear it, if not, harrow same direction of the rows, then alternate cultivating and harrowing until the cane is one foot high, stop harrowing, cut out the rows, if necessary, then finish by giving one cultivation.

The cane was taken at the mill with the blades on. To cure the blades, the cane should be cut and lie on the ground about two days before delivering. The cost of cutting and topping was from $1:75 to $2.00 per acre.

The cost of delivering cane depended on distance and the men who handled it. Where paid for by the job it cost 32 cents per ton for one-fourth mile, and 35 cents per ton for a half mile; this included board of men and teams. They delivered an average of about eight tons per day. One man drew cane from ten acres at a distance of three miles, at the rate of six tons per day. It made a big day's work, and it might be placed at fifty cents per ton, or $3.00 per day. Some of those delivering cane—were their wages counted at common rates per day, regardless of what they did,—would almost double the above figures.

When we have arrived at the same degree of skill in cultivating and handling this crop as we have in corn, the yield will doubtless be ten tons per acre, in seasons when corn produces forty bushels per acre. Counting the use of land $2.00 per acre, and good wages for all the other operations, until it is delivered at the mill, the cost per acre will vary from $12 to $14, according to distance hauled. The returns $16 to $20 per acre. Corn, figured at same rates for work delivered in crib on farm, would cost per acre, including use of land, $7 to $8. Returns forty bushels, at an average price 25 cts, $10 per acre. The cost of delivering corn to market varies too much to be estimated, on amount and distance.

In the process of manufacture, the juice as it came from the mill, passed through the sulphur machine, and was submitted to the fumes of sulphur. It was then run into 500 gallon defecators, treated with lime to almost the neutral point, heated to boiling point, skimmed, settled for about two hours, then reduced to sirup and cooled as quickly as possible by means of 115 feet of two-inch pipe, in a tank 12 feet long, 2 feet wide and one foot deep, all the cold water used being pumped through this pipe, and the syrup coming in contact with the outside. The color of syrup depending largely upon the rapidity of boiling and quickness of cooling. It was thought that a point was gained by commencing to skim the defecators at 175°, and keeping up the skimming until a full boiling point was reached. It was thought to settle better. This was only tried the latter part of the season. Another point observed for use in steam works, is that there should not be less than 150 square feet of heating surface for each 100 gallons of syrup made in 24 hours; the heating surface, including bottom of boiler, exposed to fire, and the area of the inside of the flues.

One of the effects of lime, in addition to correcting the natural acids of the juice, is to cause the green material of the juice to coagulate, and rise to the surface at a lower temperpture. By observing the process when heated over a lamp in a glass test tube, it is seen that the same conditions of juice, as it appears to the eye, are obtained with lime at 160°F., and without lime at 180°F.

IRRIGATION.

The amount that may be judiciously expended in the preparation of ground for the growing of a crop depends largely on the value of the crop when produced. Thus no one would think of expending as much in preparing the soil for an acre of wheat which may produce but $15 or $20 per acre, as he would for an acre of strawberries, which may produce from $500 to $800 per acre. The gardener and small fruit grower frequently expends in the preparation of his soil an amount which to the common farmer seems incredible. They do it because it pays, and does not pay without it. But with all their expenditures on manures, subsoiling, etc., a drouth frequently causes loss. In our own climate there are few seasons but some portion of it is affected by drouth. For illustration, potatoes which yield from 200 to 400 bushels per acre when they have sufficient water, do not on an average of years produce 75 bushels per acre. When it is considered that in our market, potatoes for seven years in the past nine years have been at some time during the season one dollar per bushel it will be seen what difference there is in returns.

In our climate the yield of strawberries one year with another is quite small, but with plenty of moisture it would be greatly increased. The average season would not exceed more than $50 per acre, when with the proper amount of moisture the average would not be less than $300 to $500 per acre. It can be readily seen that with such difference in returns it would pay to make large investments that such results might be obtained. The question to decided by experiment is whether any reasonable expenditure of means in irrigation will accomplish the results? It is generally conceded that with our supply of water that surface irrigation is too expensive. There is another method, however, which gives great promise of success. The water is supplied to the soil by means of tiles. The tiles are placed from 12 to 16 inches beneath the surface and a row of them once in ten feet. A number of rows are supplied with water at one time by means of a row of larger tiles to which the smaller ones are connected. The water passes out at the joints in the tiles and thus keeps the ground moist. There are two very important advantages in this system of irrigation.

The first is, in avoiding an immense amount of surface evaporation. The water being supplied from beneath there remains on the surface loose dry soil, which prevents in a great measure the amount of evaporation that takes place in surface irrigation.

From the best experiments that we can obtain, the amount of evaporation that would take place from our soil if it were kept saturated with water, would not be less than twenty inches for the six months beginning with April 1st. With a surface of loose dry soil, the amount of evaporation would rarely reach half this amount. There is then at least a difference of ten inches between the two methods of irrigation. The difference in the quantity of water required is as follows: One inch of water on an acre is a little over 112 tons, ten inches would be 1120 tons, or nearly 9,000—30-gallon barrels of water, which would be sufficient to keep one of our common windmills running 90 days, simply to make up the difference in evaporation between the two methods of irrigation.

The second advantage claimed is, that the surface of the soil is always in good condition. It is not alternately too wet, then baked, both of which conditions are injurious to some extent. Surface irrigation on account of the tendency to bake the surface, destroys the utility of cultivation.

With all these seemingly good points in favor of tile irrigation, it becomes our duty to test it on a large enough scale and with such a variety of crops, as will enable us to place definite information before the people in regard to its practical merits. This system has had a trial in our vicinity on a small scale, with good results. Since it has been successful and promises to be still more so when the proper preparations are made, the demand is all the greater for an immediate trial of its merits.

If by this means we can succeed in growing profitably many of the most valuable crops and small fruits, thousands of dollars which now go to other states, may be kept at home to develop our own resources.

The amount of ground proposed for irrigation by this method is five acres. This is deemed sufficient to give a fair trial to the various things that may be grown with success.

The expenses for the above, including well, pump, power, pipe, tiles, reservoir and labor, is two thousand dollars.

WEIGHT OF STOCK.

November 29, 1882, we began weighing our cattle and young horses, and expect to continue weighing them monthly.

The following table gives the weight of our thoroughbred cattle and their age at last weighing. We also give the weight of some of our grade horses and colts. The two Hereford cows had dropped calves within a month.

NAME.	BREED.	AGE WHEN WEIGHED.	W'T.
Kinnie Belle	Short Horn cow	4 years, 7 months	1400
Imogene	Hereford cow	4 " 9 "	1225
Diana	Hereford cow	2 " 2 "	900
Eighty-three	Hereford bull calf	1 month	135
Kenelm	Hereford bull calf	3 days	80
Bender	Hereford bull	1 year, 6 months.	975
Lord Stewart	Ayrshire bull	3 years, 2 months	1610
Nettie, 6th	Ayrshire cow	9 years	1085
Lucilla	Ayrshire cow	6 years	730
Roxy	Ayrshire heifer	2 years	775
Boynton	Ayrshire bull calf	7 months	350
Courtly	Ayrshire heifer calf	9 months	385
Snowflake	Galloway cow	9 years, 3 months	1135
Matilda	Galloway heifer	3 years	1190
Clinton	Galloway bull calf	10 months	450
Lockinvar	Galloway bull calf	1 "	410
Nuddy	Jersey cow	5 years, 3 months	780
Dimple	Jersey heifer calf	9 months	385
Fleck	Short Horn cow............(Grade)	7 years	1350
Lowhorns	Half Short Horn steer	3 years, 6 months	1610
Highhorns	Half Short Horn steer	3 " 6 "	1600
Coll	Half Galloway steer	2 " 6 "	1200
Taylor	Half Galloway steer	2 " 6 "	1200
Roany	Half Short Horn	1 year, 6 months.	790
Dark	Half Short Horn	1 " 6 "	840

HORSES AND COLTS.

NAME.	BREED.	AGE WHEN WEIGHED.	W'T.
Pope	Imported Clydesdale	9 years	1575
Comet	Half Clydesdale	2 " 3 months.	1110
Donald Dinnie	Three-fourths Clydesdale	1 " 6 "	960
Roger	Three-fourths Clydesdale	9 months	500
Lydia	One-half Clydesdale	9 "	525
Lassie	One-half Clydesdale	5 years, 6 months	1350